Sept. 9, 1947. F. LAMBACH 2,427,007

WARP KNITTING MACHINE

Filed Nov. 30, 1944 2 Sheets-Sheet 1

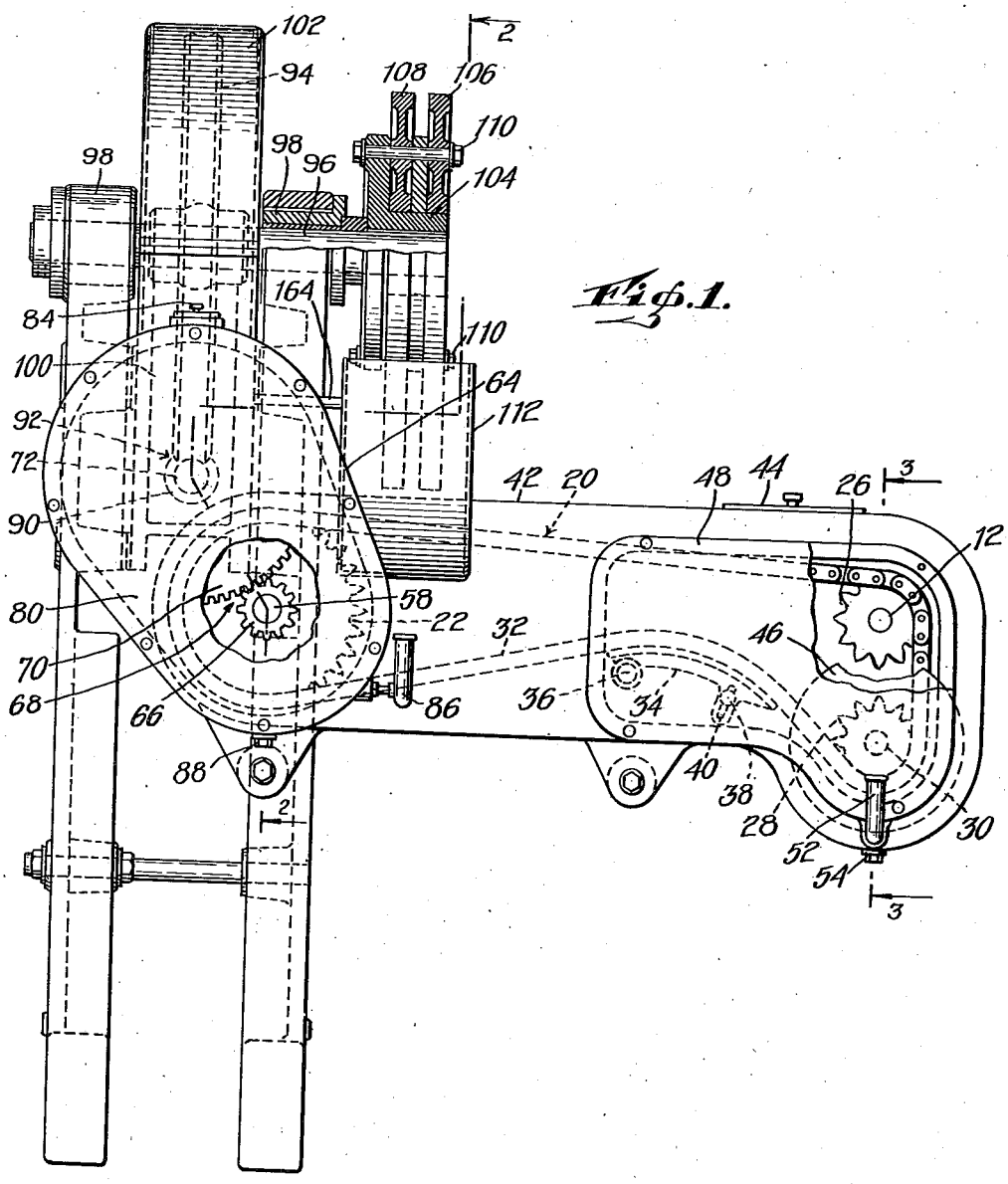

Fig. 1.

INVENTOR
FRITZ LAMBACH
BY
ATTORNEY

Sept. 9, 1947. F. LAMBACH 2,427,007

WARP KNITTING MACHINE

Filed Nov. 30, 1944 2 Sheets-Sheet 2

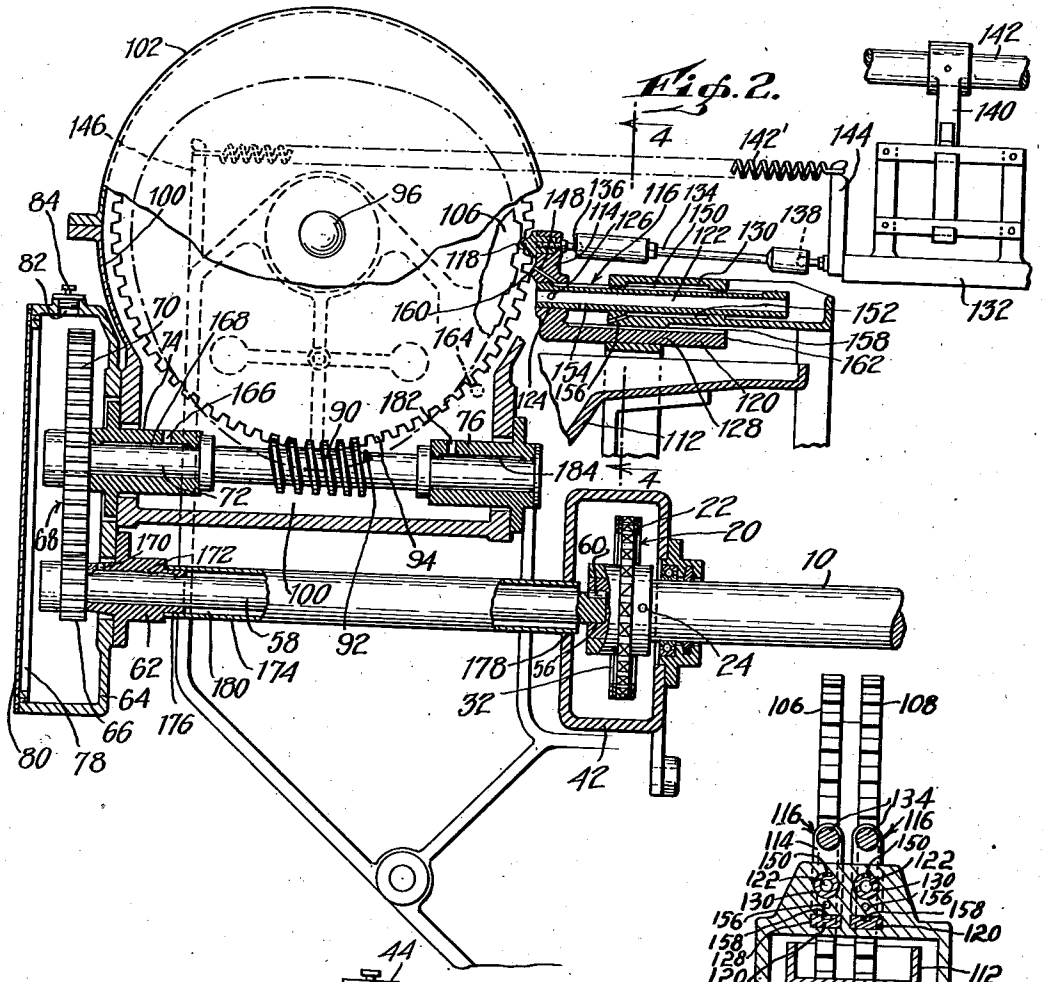

Fig. 2.

Fig. 4.

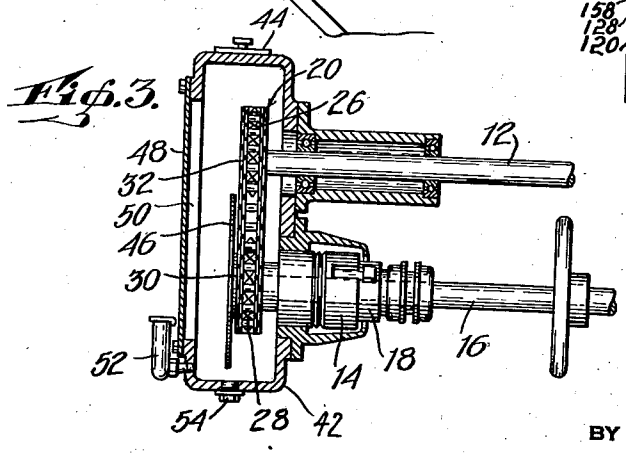

Fig. 3.

INVENTOR
FRITZ LAMBACH
BY
ATTORNEY

Patented Sept. 9, 1947

2,427,007

UNITED STATES PATENT OFFICE

2,427,007

WARP KNITTING MACHINE

Fritz Lambach, Tenafly, N. J.

Application November 30, 1944, Serial No. 565,861

12 Claims. (Cl. 66—86)

1

My invention relates to warp knitting machines, and more particularly to a lubricating system for a warp knitting machine.

An object of my invention is to provide a lubricating system, by means of which an oil film is continuously applied to all gears of the pattern wheel drive, so that a backlash resulting in an undesired rebouncing of the guide bars reciprocated by the pattern wheel mechanism is avoided.

Another object of my invention is to provide a lubricating system for the lubrication of several drives and mechanisms of the warp knitting machine spaced from each other, wherein the oil consumed at the spaced places of the drives and mechanisms may be readily replaced by supplying fresh oil to a single centralized place.

A further object of my invention is to provide a lubricating system for the pattern wheel mechanism, by means of which at least a portion of the oil supplied to the circumference of the pattern wheels may be used for a lubrication of the reciprocating elements carrying the spring loaded followers cooperating with the pattern wheels and actuating the guide bars.

Still another object of my invention is to improve upon the lubrication and construction of the pattern wheel mechanism, of the drive of the shaft actuating the take-up device, and of the drive of the pattern wheels as now ordinarily made.

A further object of my invention is to provide for a warp knitting machine, wherein the change gears included in the drive for the pattern wheels are arranged at a readily accessible place of the machine.

My invention consists in certain novel features of construction of my improvements as will be hereinafter fully described.

The above mentioned objects and advantages as well as other objects and advantages will be more fully disclosed in the following specification reference being had to the accompanying drawings forming part of this specification, wherein:

Fig. 1 is an end view of a warp knitting machine, illustrating the pattern wheels and their drive, some parts being broken away, some parts being shown in section,

Fig. 2 is a sectional view, substantially taken on line 2—2 shown in Fig. 1,

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1, and

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Referring now to the drawings, 10 indicates

2

the main driving shaft of a warp knitting machine, journalled in suitable bearings of the machine. The main driving shaft may be rotated by means of a drive, for example an electromotor, not shown.

12 indicates another shaft of the warp knitting machine, which is journalled in suitable bearings and serves to actuate the mechanism of a take-up device (not shown) for taking up the fabric knitted by the implements of the warp knitting machine; for example, such a take-up device may be of the type shown in my co-pending patent application Ser. #523,638 relating to "A take-up device for a warp knitting machine," filed on February 24, 1944, and in such a case the shaft 12 would correspond to the shaft 90 shown in the figures of my said co-pending patent application. To simplify matters, the shaft 12 is hereinafter called a "take-up shaft."

14 indicates a clutch member rotatably but axially immovably arranged on a hand wheel shaft 16 for cooperation with a clutch member 18 positively coupled with and axially movably arranged on said hand wheel shaft 16. Said clutch 14, 18, by means of which the hand wheel shaft 16 may be operatively engaged with or disengaged from the main driving shaft may be of the type described in my U. S. Patent 2,363,535 relating to "A knitting machine," issued November 28, 1944, for example.

According to the embodiment shown in the drawings, the main driving shaft 10, the take-up shaft 12 and the clutch member 14 are operatively connected with each other by a chain drive generally indicated by 20. As shown in the drawings, a sprocket gear 22 arranged at the end of the main shaft 10 is secured to the latter by means of a pin 24, a sprocket gear 26 is keyed to the take-up shaft 12, a sprocket gear 28 is integral with or rigidly secured to the body of the clutch member 14, and a chain 32 is trained around said three sprocket gears 22, 26, 28. As will be apparent from above, a rotation of the main driving shaft 10 causes a rotation of the take-up shaft 12 and the clutch member 14 through the medium of the chain drive 20; likewise, if the clutch member 18 is engaged with the clutch member 14, a rotation of the hand-wheel shaft 16 causes a rotation of the main driving shaft 10 and the take-up shaft 12 through the medium of the chain drive 20.

According to the invention, said chain drive 20 is arranged within a casing 42 secured in a suitable manner to stationary parts of the frame of the warp knitting machine. Oil or any other

suitable lubricant may be put into said casing 42 through an opening capable of being closed by a cover 44. The oil brought into the casing 42 will form an oil sump therein, by means of which the elements of the chain drive 20 are continuously lubricated during the operation of the warp knitting machine. If desired, a disk-like oil thrower 46 may be secured to the flange like portion 30 of the clutch member 14 for rotation therewith, so as to assist in the lubrication of the chain drive 20.

In order to adjust the tension in the chain 32, an adjusting element 34 contacting the chain is swingably mounted at 36 in the casing 42. Said element 34 may be held in its position by a set screw 38 passing through a slot 40 of this element 34.

48 indicates a cover plate detachably mounted on the casing 42 for covering an opening 50. 52 indicates an oil drain pot communicating with the interior of the casing 42. 54 indicates a plug screwed into a threaded opening of the casing 42; if desired, the oil may be discharged from the container 42 by a removal of said plug 54.

As best shown in Fig. 2, the end of the main driving shaft 10 has a recess 56, and one end of a connecting shaft 58 coaxially arranged with the main driving shaft 10 is engaged with said recess 56. A key 60 carried by the connecting shaft 58 and engaged with a groove in the main driving shaft 10 causes a positive coupling between the connecting shaft 58 and the main driving shaft 10, so that a rotation of the main driving shaft 10 results in a rotation of said connecting shaft 58. The other end of said connecting shaft 58 is journalled in a bearing 62 secured to a casing or container 64 mounted on a stationary part of the warp knitting machine. A first change gear 66 of a change gear drive generally indicated by 68 is exchangeably secured to the end of the connecting shaft 58 in a manner, known per se. Said first change gear 66 is in mesh with a second change gear 70 of said change gear drive 68. Said second change gear 70 is exchangeably secured to the end of a shaft 72 journalled in bearings 74 and 76. The casing 64 arranged at the end of the warp knitting machine has an opening 78, normally covered by a cover plate 80 detachably mounted on the casing 64. Upon removal of said cover plate 80, the change gear drive 68 is readily accessible to the operator of the machine for a change of the set of change gears. When the proper change gears 66, 70 are mounted on the connecting shaft 58 and the shaft 72, the cover plate 80 is attached to the casing 64. Now, oil may be put into the casing 64 through an opening 82 which, thereupon, may be closed by a cover 84. The oil brought into the casing 64 forms an oil sump therein for a continuous lubrication of the gears of the change gear drive 68, during an operation of the warp knitting machine.

86 indicates an oil drain pot communicating with the interior of the casing 64. 88 indicates a plug, normally closing an opening at the bottom of the casing 64, which however may be removed for a discharge of the oil therein, whenever a change of the change gear drive has to be carried out.

The shaft 72 rotated by the gear 70 of the change gear drive 68 carries a worm 90 of a worm gear drive, generally indicated by 92. Said worm 90 is in mesh with a worm gear 94 keyed to a shaft 96, journalled in bearings 98 of the frame of the machine. The worm gear drive 92 is arranged within a casing or container 100 closed by a cover 102. Before closing said casing 100 by the cover 102, oil may be filled into the casing 100 for a lubrication of the worm gear drive.

A disk-like support 104 is keyed to the end of the shaft 96 for a rotation by said shaft 96. A first pattern wheel 106 and a second pattern wheel 108 are secured to said support 104 by means of bolts 110. The lower portion of each of said pattern wheels 106, 108 dips into an oil sump formed by oil, placed into an open casing or tank 112, suitably mounted on a stationary part of the machine.

Referring now to Figs. 2 and 4, each upright portion 114 of two supporting members generally indicated by 116 carries a roller 118 for engagement with the circumference of a pattern wheel. The base 120 of each supporting member 116 and a hollow rod 122 inserted into an opening 124 of each supporting member and secured thereto by a pin 126 are slidably arranged for reciprocating movements in suitable bearings 128 and 130 arranged on a stationary part of the machine. There are two followers 134, one for the actuation of a first guide bar 132, the other for the actuation of a second guide bar (not shown in Fig. 2), which is arranged in a plane behind the plane of the first guide bar, as viewed in Fig. 2. The actuation of both guide bars carrying the thread guides (not shown) by the pattern wheels is identical, so that a description of the actuation of the guide bar 132 shown in Fig. 2 is sufficient for an understanding of said mechanisms. One end of such a follower 134 is in movable engagement with a ball 136 arranged opposite the roller 118 on the upright portion 114 of the supporting member 116; the other end of said follower 134 is in movable engagement with a ball 138 connected with the end of the guide bar 132 suspended from a holder 140, secured to a shaft 142 axially movably and rotatably arranged in the frame of the machine. A spring 142' stretched between an extension 144 of the guide bar 132 and a stationary part 146 of the machine tends to urge the follower 134 towards the pattern wheel so as to hold the roller 118 in engagement with the circumference of said pattern wheel. Obviously, depending on the shape of the pattern wheel and the shape of the cams on the circumference of the pattern wheel, the supporting member 116, the follower 134, and the guide bar 132 are subjected to reciprocating movements. According to the embodiment shown in Fig. 2, the longitudinal axis of the follower 134 is substantially in the horizontal plane placed through the axis of the shaft 96 so that forces displacing the guide bar are transmitted substantially in the direction of the longitudinal axis of the follower 134 from the pattern wheel to the guide bar.

According to Figs. 2 and 4 ducts, channels, or passages 148, 150, 152, 154, 156, 158 are arranged in each supporting member 116 in such a way, that they connect a point 160 on its surface adjacent the circumference of a pattern wheel with a point 162 on its surface above and adjacent the casing 112, and that, in part, said ducts, channels, or passages pass through the bearings 130 and 128. Therefore, during the operation of the machine, oil supplied to the circumference of the pattern wheels by the oil sump in the casing 112 and thrown off the circumference of the pattern wheels by centrifugal forces will enter the ducts 148 at 160, will pass through the bearings 130 and 128 for a lubrication thereof,

and will return into the casing 112, by leaving the channels 158 at 162.

Furthermore, according to the embodiment shown in the drawings, the following supply connections are arranged between the oil sumps in the casings 112, 100, 64 and 42 of the lubricating system:

A pipe line 164 connects the interior of the casing 112 with the interior of the casing 100. The bearing 74 of the shaft 72 is provided with a bore 166 and a groove 168 connecting the interior of the casing 100 with the inner surface of the bearing 74. Likewise the bearing 62 of the connecting shaft 58 is provided with a bore 170 and a groove 172 connecting the interior of the casing 64 with the inner surface of the bearing 62. Moreover, the connecting shaft 58 is surrounded by a tube 174 of somewhat larger diameter than the diameter of the connecting shaft 58. One end of said tube 174 is mounted on a shoulder 176 of the bearing 62, and the other end of said tube projects into the casing 42 through an opening 178 of the latter. Thus, the tube 174 forms a channel 180 leading from the end of the bearing 62 to the interior of the casing 42.

Furthermore, the bearing 76 of the shaft 72 carrying the worm 90 is provided with a bore 182 and a groove 184 connecting the interior of the casing 100 with the inner surface of said bearing 76.

Prior to the start of the warp knitting machine, oil is filled into the casings 42, 64, 100 and 112 so as to form oil sumps therein for a lubrication of the chain drive 20, the change gear drive 68, the worm gear drive 92, the pattern wheels 106, 108, and the supporting members 116 carrying the followers 134.

During an operation of the warp knitting machine, a rotation of the main driving shaft 10 by an electromotor or other suitable drive causes a rotation of the take-up shaft 12 and of the clutch member 14 by means of the chain drive 20. Furthermore, said rotation of the main driving shaft 10 causes a rotation of the pattern wheels 106, 108 through the medium of the connecting shaft 58, change gear drive 68, and worm gear drive 92; the rotation of the pattern wheels, in turn, results in a reciprocating movement of the guide bars 132 by means of the spring-loaded followers 134.

When the drives are in operation, the chain drive 20 is lubricated by the oil sump in the casing 42, the change gear drive 68 is lubricated by the oil sump in the casing 64, the worm gear drive 92 is lubricated by the oil sump in the casing 100, and the pattern wheels 106, 108 are lubricated by the oil sump in the casing 112. Furthermore, the bearings 128 and 130 of the supporting member 116 are lubricated by oil thrown off the circumference of the pattern wheels 106, 108 for passage through the ducts 148, 150, 152, 154, 156, 158, the bearings 74 and 76 of the shaft 72 are lubricated by some oil dropping from the worm gear 94 and passing through the ducts 166, 168 and 182, 184, and the bearing 62 of the connecting shaft 58 is lubricated by some oil thrown by the change gears 66, 70 against the walls of the casing 64, which drops from said walls and enters the ducts 170, 172. Thus, all elements of the drives described above are efficiently and continuously lubricated during the operation of the warp knitting machine.

A certain amount of oil may trickle from the bearing 62 and pass through the channel 180

into the casing 42 so as to replace oil consumed by the lubrication of the chain drive 20. Likewise, a certain amount of oil may trickle from the bearing 74 and drop into the casing 64 so as to replace oil consumed therein. Furthermore, excess oil filled into the casing 112 may pass through the overflow or connecting pipe line 164 into the casing 100 so as to replace oil consumed therein. Thus, the oil consumed at the various places of lubrication, which are remote from each other, may be readily replaced by filling a supply of fresh oil into the accessible open container 112 serving as a centralized refilling station for the entire lubricating system.

I have described a preferred embodiment of my invention, but it is clear that numerous changes and omissions may be made without departing from the spirit of my invention.

For example, instead of the chain drive 20, a different drive of the take-up shaft 12 and the clutch member 14 may be arranged in the casing 42 for a lubrication of all elements of said drive; if desired, the chain drive may connect only the driving shaft with the take-up shaft and the take-up shaft may be connected with the clutch member by a separate set of gears, as shown for example in my co-pending patent application Ser. #523,638 relating to "A take-up device for a warp knitting machine," filed February 24, 1944.

Although, according to the preferred embodiment shown in the drawings, an oil sump is provided for the lubrication of each of the drives described above and supply connections are arranged between the various oil sumps, it is understood that one or more oil sumps and/or one or more supply connections between oil sumps may be omitted.

What I claim is:

1. In a warp knitting machine having a main driving shaft, a take-up shaft, a hand wheel shaft, a first clutch member connected with said hand wheel shaft, and a second clutch member arranged for cooperation with said first clutch member, the combination of a drive connecting said main driving shaft with said take-up shaft and with said second clutch member, and a casing having a sump capable of receiving oil, said drive being arranged in said casing for lubrication by oil in said sump.

2. In a warp knitting machine having a main driving shaft, a take-up shaft, a hand wheel shaft, a first clutch member connected with said hand wheel shaft, and a second clutch member arranged for cooperation with said first clutch member, the combination of a first sprocket connected with said main driving shaft, a second sprocket connected with said take-up shaft, a third sprocket connected with said second clutch member, a chain trained around said three sprockets, and a casing having a sump capable of receiving oil, said chain being arranged in said casing for lubrication by oil in said sump.

3. A warp knitting machine comprising a main driving shaft, a take-up shaft, a hand wheel shaft, a first clutch member connected with said hand wheel shaft, a second clutch member arranged for cooperation with said first clutch member, a first sprocket connected with said main driving shaft, a second sprocket connected with said take-up shaft, a third sprocket connected with said second clutch member, and a chain trained around said three sprockets.

4. In a warp knitting machine having a main driving shaft, guide bars, and pattern wheels for

the reciprocation of said guide bars, the combination of a drive interposed between said main driving shaft and said pattern wheels for a rotation of the latter, bearings, following means connected with said guide bars, said following means being slidably mounted in said bearings, means arranged for holding said following means in engagement with said pattern wheels for an actuation by the latter, a casing having a sump capable of receiving oil, said pattern wheels being arranged for dipping into oil in said sump so as to be lubricated at their surface, and means for leading oil from the surface of the pattern wheels to said bearings.

5. A warp knitting machine as claimed in claim 4, including means for returning the oil from said bearings to the sump in said casing after the lubrication of said bearings.

6. In a warp knitting machine as claimed in claim 4, said following means being provided with passages having an inlet at a point adjacent the pattern wheels, passing through said bearings, and having an outlet at a point adjacent said casing, whereby oil thrown off the pattern wheels during a rotation thereof is returned into the sump in said casing after a lubrication of said bearings.

7. In a warp knitting machine having a main driving shaft, a take-up shaft, guide bars, and pattern wheels for the reciprocation of said guide bars, the combination of a first drive interposed between said main driving shaft and said take-up shaft for rotating the latter, a second drive interposed between said main driving shaft and said pattern wheels for rotating the latter, a casing having a sump capable of receiving oil, at least one container having at least one sump capable of receiving oil, said first drive being arranged in said casing for lubrication by oil in the sump thereof, said second drive being arranged in said container for lubrication by oil in the sump thereof, and oil supply connections between said casing and said container.

8. In combination with a warp knitting machine as claimed in claim 7, a tank having a sump capable of receiving oil, said pattern wheels being arranged for dipping into oil in the sump of said tank, and an overflow between said tank and said container.

9. In combination with a warp knitting machine as claimed in claim 7, bearings, following means connected with said guide bars, said following means being slidably mounted in said bearings, means arranged for holding said following means in engagement with said pattern wheels for an actuation by the latter, a tank having a sump capable of receiving oil, said pattern wheels being arranged for dipping into oil in the sump of said tank so as to be lubricated at their surface, means for leading oil from the surface of the pattern wheels to said bearings, means for returning the oil from said bearings to said tank after lubrication of said bearings, and an overflow between said tank and said container.

10. In a warp knitting machine having a main driving shaft, a take-up shaft, guide bars, and pattern wheels for the reciprocation of said guide bars, the combination of a first drive interposed between said main driving shaft and said take-up shaft for rotating the latter, a second drive interposed between said main driving shaft and said pattern wheels for rotating the latter, said second drive including a change gear drive and a worm gear drive coupled with each other, a first casing having a first sump capable of receiving oil, a second casing having a second sump capable of receiving oil, a third casing having a third sump capable of receiving oil, said first drive being arranged in said first casing for lubrication by oil in said first sump, said change gear drive being arranged in said second casing for lubrication by oil in said second sump, said worm gear drive being arranged in said third casing for lubrication by oil in said third sump, and oil supply connections between said three casings.

11. In combination with a warp knitting machine as claimed in claim 10, a fourth casing having a fourth sump capable of receiving oil, said pattern wheels being arranged for dipping into oil in said fourth sump, and an overflow between said fourth casing and said third casing.

12. In combination with a warp knitting machine as claimed in claim 10, bearings, following means connected with said guide bars, said following means being slidably mounted in said bearings, means arranged for holding said following means in engagement with said pattern wheels for an actuation by the latter, a fourth casing having a fourth sump capable of receiving oil, said pattern wheels being arranged for dipping into oil in said fourth sump so as to be lubricated at their surface, means for leading oil from the surface of the pattern wheels to said bearings, means for returning the oil from said bearings to said fourth casing after lubrication of said bearings, and an overflow between said fourth casing and said third casing.

FRITZ LAMBACH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,981,511	Kinsella	Nov. 20, 1934
2,110,541	Winter	Mar. 8, 1938
2,130,979	Wirth	Sept. 20, 1938
2,363,535	Lambach	Nov. 28, 1944
1,858,533	White	May 17, 1932
1,878,379	Church	Sept. 20, 1932
1,667,285	Clisson	Apr. 24, 1928
1,673,566	Himes	June 12, 1928
1,680,328	Eicher	Aug. 14, 1928
1,686,271	George	Oct. 2, 1928
1,984,148	Morrish	Dec. 11, 1934

FOREIGN PATENTS

Number	Country	Date
627,392	Germany	Mar. 14, 1936